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FLOOD INSURANCE STUDY

ORIGINAL

BOROUGH OF INDIANA, PENNSYLVANIA
INDIANA COUNTY

AM/SI

MAY 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 420501

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
BOROUGH OF INDIANA, INDIANA COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Indiana, Indiana County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Army Corps of Engineers (COE), Pittsburgh District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-E-1153, Project Order No. 1, Amendment No. 20. This work was completed in September 1985.

1.3 Coordination

On July 28, 1983, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives from FEMA, the Township of White, the Pennsylvania Department of Community Affairs, and the COE (the study contractor) to determine the streams to be studied by detailed methods. Representatives from the Borough of Indiana were unable to attend; therefore, the scope of study was determined by input from the Township of White and the Pennsylvania Department of Community Affairs representative. Coordination of this study involved Notice of Initiation

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letters, public meetings, and incidental meetings with Borough Officials. Notice of Initiation letters dated December 1, 1983, announced the start of the study and were sent to all Federal, State, county, and local government agencies and private firms that could possibly make input to the study.

On June 25, 1986, a final CCO meeting was held with representatives from FEMA, the borough, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Indiana, Indiana County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

Whites Run and Marsh Run were studied by detailed methods for their entire lengths within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through September 1990.

Two unnamed tributaries were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Borough of Indiana.

2.2 Community Description

The Borough of Indiana is located in the center of Indiana County in southwestern Pennsylvania, approximately 50 miles northeast of Pittsburgh. The total land area contained within Indiana is 1.6 square miles. The borough is completely surrounded by the Township of White. According to the U. S. Bureau of the Census, the population of Indiana was 16,051 in 1980, a 0.3 percent decrease from 16,100 in 1970 (Reference 1).

Whites Run, with a total drainage area of 1.08 square miles at its confluence with Stoney Run, has its source approximately 0.5 mile north of the borough. The stream flows in a generally southern direction to its confluence with Stoney Run. The average slope of Whites Run is approximately 42 feet per mile. Within the community, development is both residential and light commercial.

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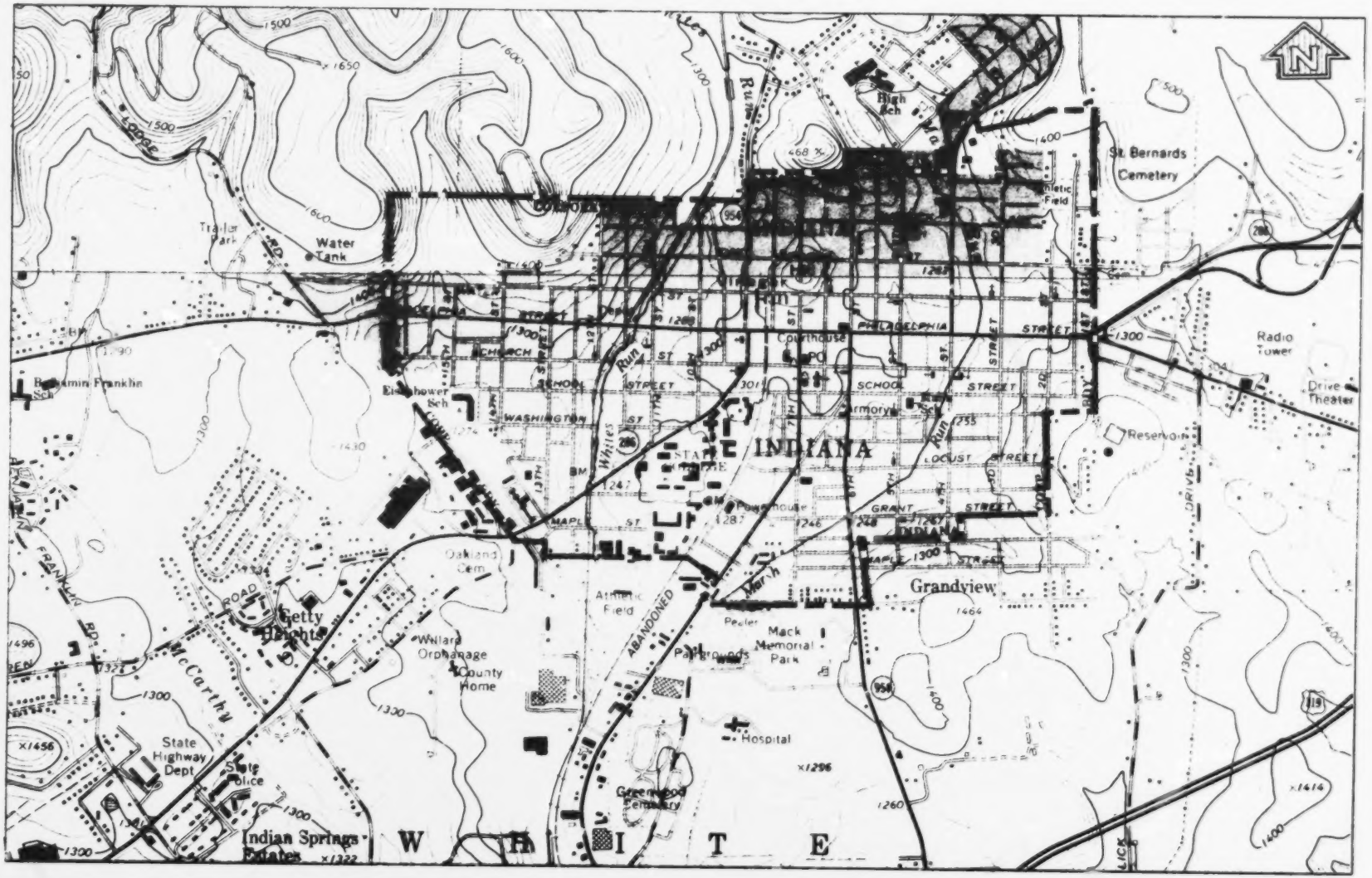

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF INDIANA, PA

(INDIANA CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

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Marsh Run, with a total drainage area of 2.06 square miles at its confluence with Stoney Run, joins with Whites Run to form Stoney Run. The headwaters of the stream are located immediately north of the corporate limits of the borough. Marsh Run flows in a generally southwestern direction throughout its entire length. The average gradient of the stream is approximately 25 feet per mile. Local relief above the stream valley varies from a low of 1,240 feet to an average hilltop elevation of 1,560 feet. Development within the floodplain of Marsh Run is mostly residential.

The climate for this area is temperate with seasonal variation in temperature. The borough is geographically located in a region of both polar and tropical air mass activity, subjected to continental and maritime invasion. The weather is usually moderate but may have occasional rapid changes resulting from frontal air mass movements. Temperatures range from highs of 90 degrees Fahrenheit (°F) to lows of 0°F with an annual average of 50°F. The average yearly rainfall is 47 inches.

2.3 Principal Flood Problems

There are no historical data available for Whites and Marsh Runs. From field observation, the streams are more susceptible to flash flooding from intense, short duration summer storms.

The most recent flood to have occurred on Whites and Marsh Runs took place in February 1984. Other floods took place in July 1977, and June and September 1972.

2.4 Flood Protection Measures

Presently, there are no flood protection projects on Whites and Marsh Runs that would affect flooding in the Borough of Indiana, and there are no plans for such structures in the foreseeable future.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average

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period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

There are no gage or stream flow records available for Whites Run or Marsh Run. Flows for the 10-, 50-, 100-, and 500-year frequency floods were developed using multiple regression formulae developed by the COE (Reference 2). These formulae relate discharge to drainage area, channel slope, and watershed shape, and were developed from an analysis of natural flow frequencies from gaged watersheds. Flows were then adjusted proportionally as outlined by the U. S. Geological Survey (USGS) Circular 554 to reflect the effect of urbanization (Reference 3).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WHITES RUN					
At confluence with Stoney Run	1.08	400	650	810	1,240
Just below Gompers Street	0.52	160	290	360	560
MARSH RUN					
At confluence with Stoney Run	2.06	810	1,290	1,540	2,370
Just above Philadelphia Street	1.35	530	840	1,000	1,550

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-sectional data for the backwater analysis for Whites Run and Marsh Run were obtained from field surveys and topographic maps compiled from aerial photographs at a scale of 1:4,800 with a contour interval of 4 feet (Reference 4). All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Whites and Marsh Runs were taken from the Flood Insurance Study for the Township of White (Reference 6).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen on the basis of field inspection and verification. The channel "n" values for Whites Run ranged from 0.015 to 0.045, and the overbank "n" value was 0.080. The channel "n" value for Marsh Run was 0.040, and the overbank "n" values ranged from 0.040 to 0.070.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

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4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 4).

For the streams studied by approximate methods, the 100-year flood boundary was delineated using the Flood Hazard Boundary Map for the Borough of Indiana (Reference 7).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

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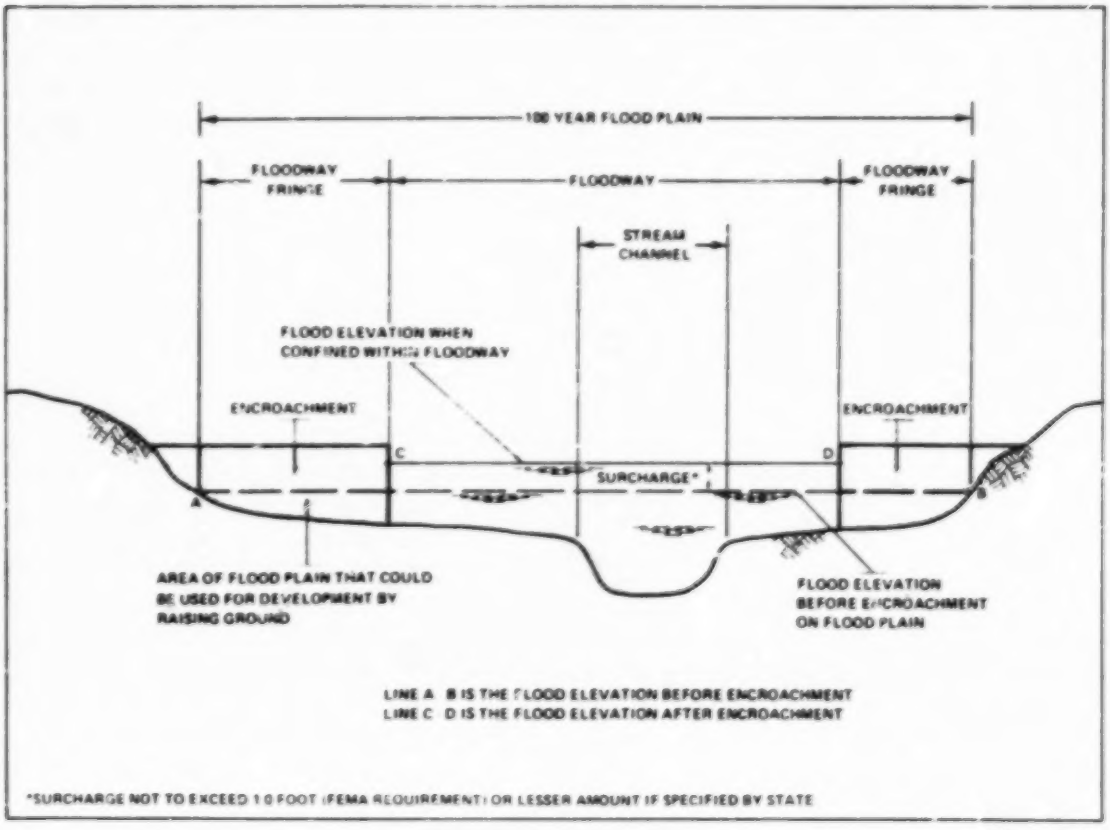
The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

Figure 2

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Whites Run								
A	0.374	35	134	6.0	1,244.3	1,244.3	1,244.5	0.2
B	0.484	83	149	5.4	1,249.2	1,249.2	1,249.5	0.3
C	0.660	99	367	2.2	1,252.5	1,252.5	1,253.0	0.5
D	0.863	68	154	5.3	1,258.0	1,258.0	1,258.7	0.7
E	1.373	55	381	0.9	1,278.9	1,278.9	1,279.9	1.0
Marsh Run								
A	0.342	233	703	2.2	1,241.7	1,241.7	1,242.7	1.0
B	0.535	105	433	3.6	1,244.5	1,244.5	1,244.8	0.3
C	0.779	135	640	2.4	1,250.7	1,250.7	1,251.2	0.5
D	1.036	265	457	3.4	1,254.9	1,254.9	1,255.2	0.3
E	1.325	75	214	7.2	1,263.1	1,263.1	1,263.1	0.0
F	1.614	95	396	2.5	1,274.3	1,274.3	1,275.2	0.9

[1]Miles above confluence with Stoney Run

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF INDIANA, PA
(INDIANA CO.)

FLOODWAY DATA

MARSH RUN - WHITES RUN

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5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

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Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

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7.0 OTHER STUDIES

A Flood Insurance Study for the Township of White is being prepared (Reference 6). The results of that study will be in complete agreement with the results of this study.

A Flood Hazard Boundary Map has been published for the community (Reference 7). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Pennsylvania, Washington, D. C., U. S. Government Printing Office, 1981.

2. U. S. Army Corps of Engineers, Pittsburgh District, "Untitled Regression Data," Pittsburgh, Pennsylvania, 1975.

3. U. S. Department of the Interior, Geological Survey, Circular 554, Hydrology for Urban Land Planning-A Guidebook on the Hydrologic Effects of Urban Land Use by Luno B. Leopold, Washington, D. C., 1968.

4. Michael Baker, Jr., Inc., of Beaver, Pennsylvania, Topographic Maps compiled from aerial photographs, Scale 1:4,800, Contour Interval 4 Feet: Indiana, Pennsylvania, November 1983.

5. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, October 1973.

6. Federal Emergency Management Agency, Flood Insurance Study, Township of White, Indiana County, Pennsylvania (Unpublished).

7. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Borough of Indiana, Indiana County, Pennsylvania, July 14, 1978.

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EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	1,265.97	Cut U at center of upstream side of Water Street bridge over Whites Run.
RM 2	1,258.23	Cut U at center of upstream side of Church Street bridge over Whites Run.
RM 3	1,253.46	Cut U at center of upstream side of Washington Street bridge over Whites Run.
RM 4	1,248.71	Cut U on top of upstream side concrete rail of Maple Street bridge over Whites Run.
RM 5	1,272.41	Cut U at centerline of Oak Street bridge over Marsh Run.
RM 6	1,261.90	Cut U at center of upstream side of School Street bridge over Marsh Run.
RM 7	1,252.23	Cut U at center of upstream side of Locust Street bridge over Marsh Run.
RM 8	1,248.82	Cut U at center of upstream side of South Sixth Street bridge over Marsh Run.
RM 9	1,242.95	Cut L on end of upstream east wing wall of Maple Street bridge over Marsh Run.

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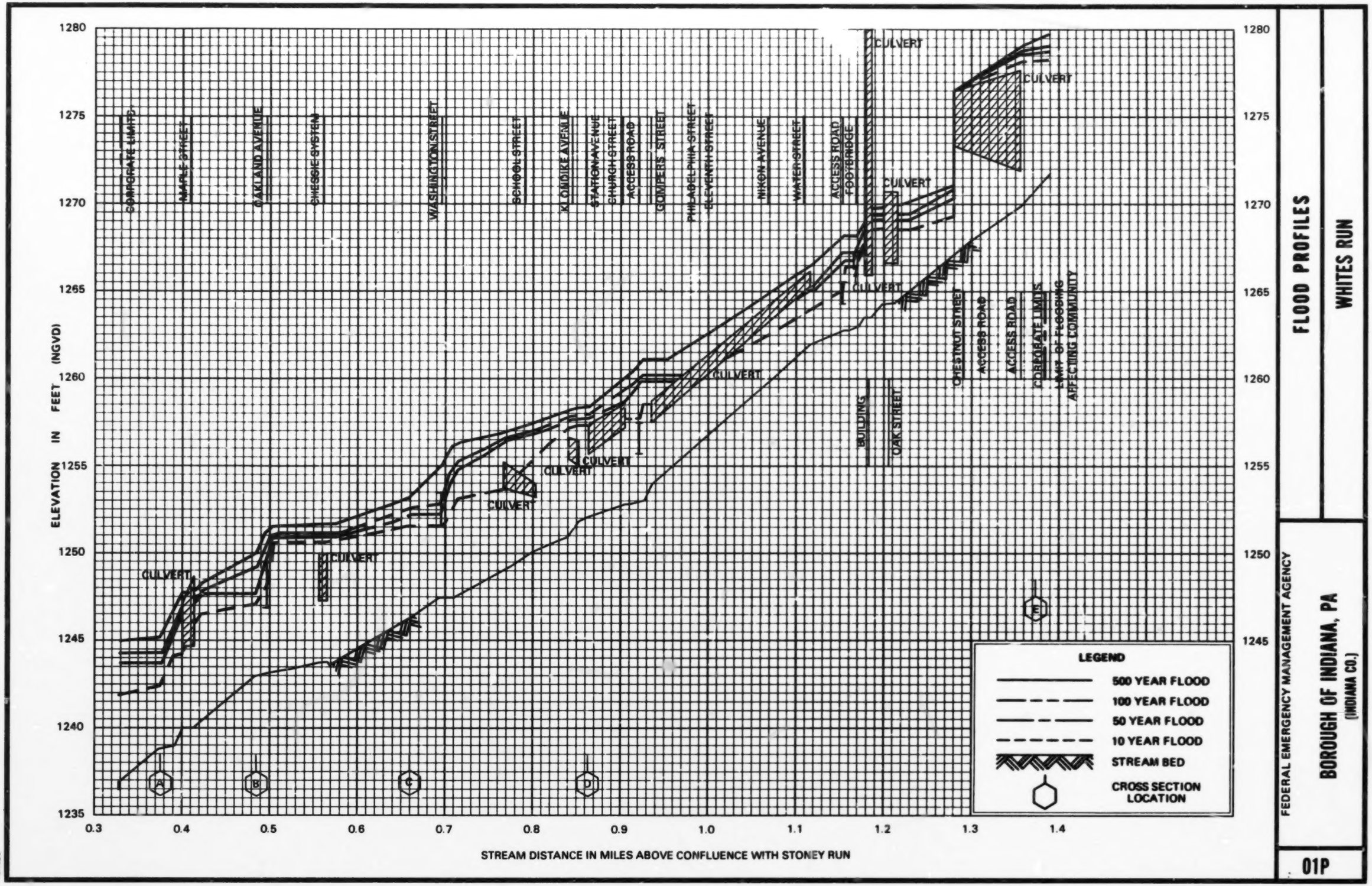

FLOOD PROFILES

WHITES RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF INDIANA, PA
(INDIANA CO.)

01P

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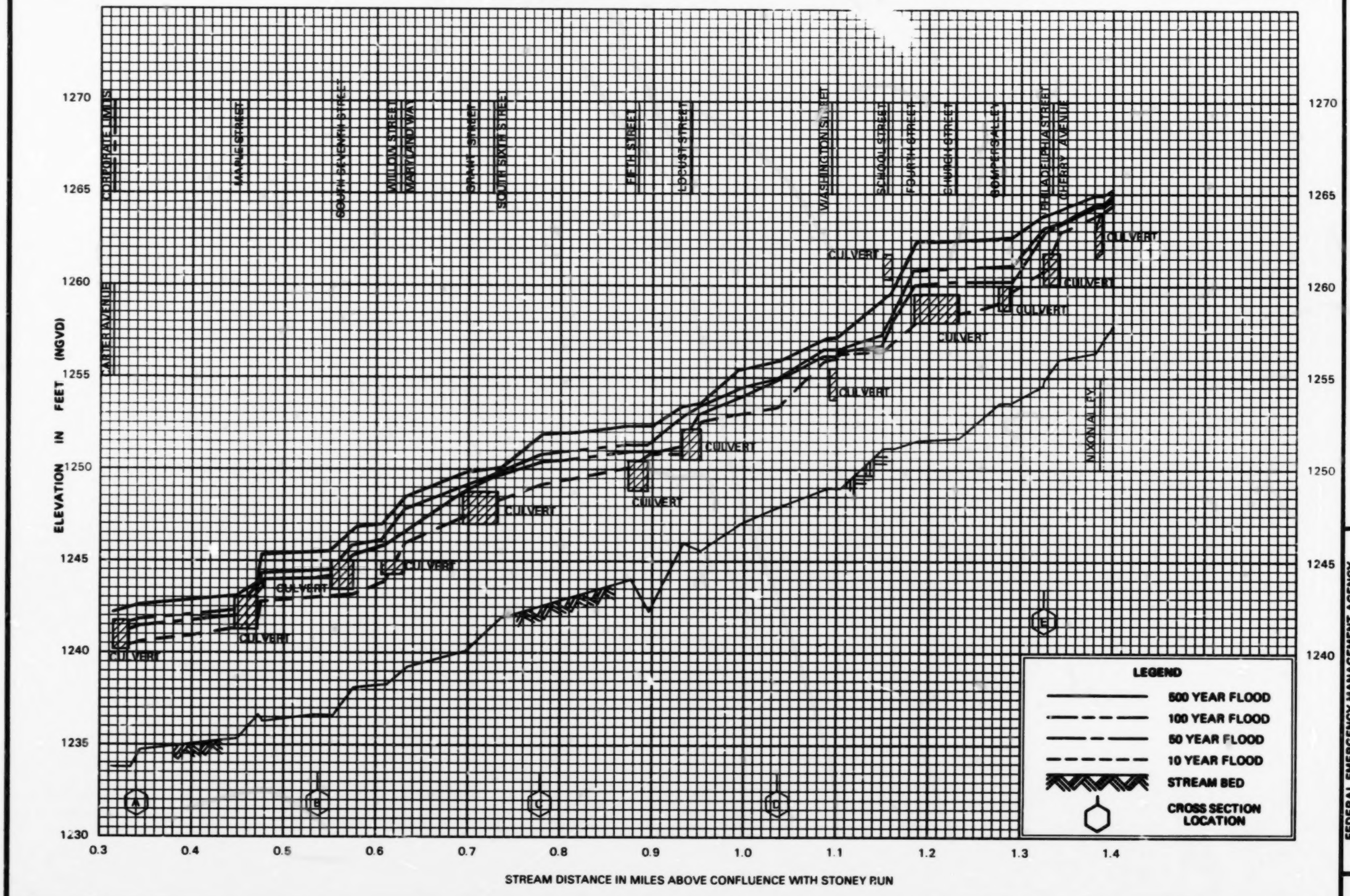

FLOOD PROFILES

MARSH RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF INDIANA, PA
(INDIANA CO.)

02P

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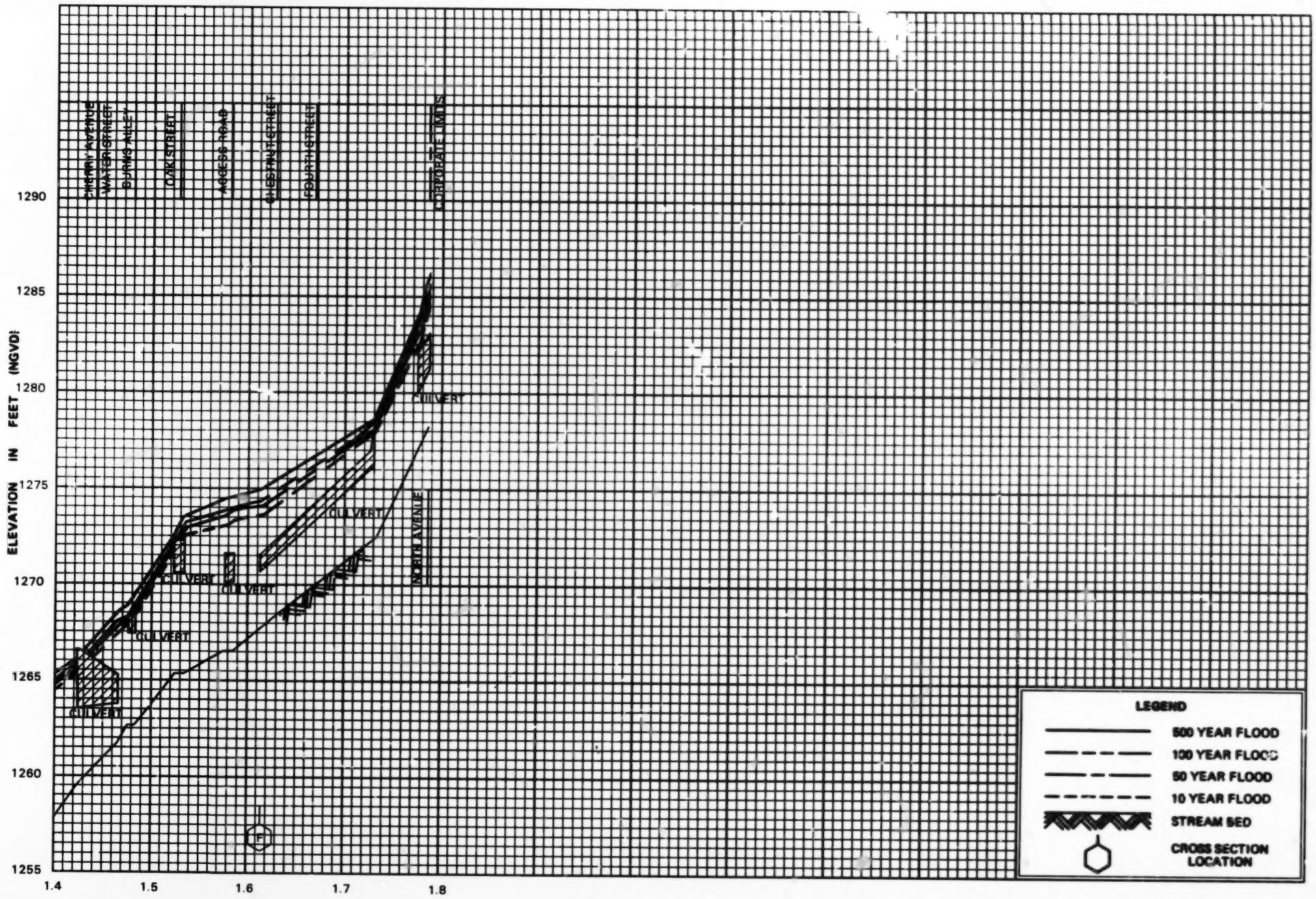

FLOOD PROFILES

MARSH RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF INDIANA, PA
(INDIANA CO.)

03P

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